Physics

CONSTRAINTS ON NON-GAUSSIANITY IN THE COSMIC MICROWAVE BACKGROUND ANISOTROPIES

Michael D. Schneider and Benjamin D. Wandelt*

Department of Physics
1110 West Green Street
Urbana, IL 61801-3080
mdschnei@uiuc.edu

The standard big bang cosmological scenario includes an early epoch of exponential expansion of the universe, called inflation. During inflation, primordial metric perturbations are created that later seed the formation of structure in the universe. In particular, the primary anisotropies in the cosmic microwave background (CMB) have their origin in the perturbations from inflation. At large scales, the CMB anisotropy is a direct probe of the primordial perturbation spectrum, which is predicted to be Gaussian in standard models. The presence and degree of non-Gaussianity in the CMB anisotropies constrains the dynamics of inflationary models.

This project describes an algorithm to constrain the nonlinear coupling parameter in a model of non-Gaussian CMB fluctuations by computing the posterior distribution of the nonlinear parameter, given a temperature map. The Fisher matrix is computed to get an estimate of the expected variance of the posterior. In addition, samples are drawn from the posterior distribution using a new sophisticated algorithm that combines the Gibbs sampler and Metropolis-Hastings Monte Carlo algorithms with a routine inspired by simulated tempering schemes. The variance of the numerical results closely matches the theoretical expectation and is a significant improvement over previous analyses of non-Gaussianity in the CMB using the bispectrum as the analysis statistic.